

## A REVISION OF EASTERN NORTH AMERICAN SPECIES OF *ATYLOTUS* (DIPTERA: TABANIDAE) WITH KEYS TO ADULT AND IMMATURE STAGES

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### Abstract

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Adults of ten species of *Atylotus* from eastern North America, including three new ones (*palus*, *hyalicosta*, and *sphagnicolus*), are described. Larvae and pupae of two of these are also described for the first time. The Holarctic distribution of *Atylotus sublunaticornis* (Zetterstedt) is recognized. *Atylotus pemeticus* (Johnson) is synonymized with *A. intermedius* Walker. Keys to adults of all 14 species of North American *Atylotus* and to larvae and pupae of 11 species are presented.

### Introduction

*Atylotus* was first proposed as a subgenus of *Tabanus* by Osten Sacken (1876) who included two species, *bicolor* Wiedemann and *fulvescens* Walker. The latter species was synonymized under *bicolor* by Stone (1938). He also elevated *Atylotus* to generic ranking and included the additional North American species, *insuetus* Osten Sacken, *ohioensis* Hine, *pygmaeus* Williston, *pemeticus* Johnson and *thoracicus* Hine. (*Tabanus duplex* Walker, listed by Stone as unrecognized, is also now recognized as a species of *Atylotus* occurring widely in eastern North America). A year earlier, but apparently unknown to Stone, the uniqueness of *pygmaeus* had been recognized by Fairchild (1937), who made it the type species of *Microtabanus*, where it still stands. Subsequently, *utahensis* Rowe and Knowlton (1935) and *tingaureus* Philip (1936), which have variously been considered as varieties, subspecies or species related to *insuetus*, were added to the complement of the genus. Philip (1941) then synonymized *insuetus* and *Tabanus intermedius* Walker, another species which Stone listed as an unrecognized North American species, under *incisuralis* (Macquart). Pechuman (1981), having seen specimens from Michigan resembling the description of *intermedius*, examined the types of *intermedius* and *incisuralis* and confirmed that the former species occurs in North America and that the latter showed no close resemblance to any North American species. This has meant the reinstatement of *insuetus*. Pechuman also described in the same paper a new eastern North American species, *Atylotus woodi*, having frontal calli similar to *intermedius*, *insuetus*, *utahensis* and *tingaureus*. Teskey (1983) then described *Atylotus calcar*, a new western North American species that had previously been confused with *insuetus*, and provided further evidence confirming the specific status of *utahensis* and *tingaureus*.

The identity of those members of *Atylotus* having frontal calli are, therefore, now well established. The same cannot be said for the remaining members of the genus in North America lacking frontal calli. As the writer is currently preparing a manual to the Tabanidae of Canada and Alaska, it was deemed necessary to clarify at least some of the taxonomic problems associated with this group, thus the purpose of this study.

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### *Atylotus* Osten Sacken

*Atilotus* Osten Sacken, Mem. Boston Soc. Nat. Hist. 2:426, 1876 (as subg. of *Tabanus*); type species *Tabanus bicolor* Wiedemann.

*Ochrops* Szilady, Ent. Mitt. 493, 1915; type species *Tabanus plebejus* Fallen.

*Dasystypia* Enderlein, Mitt. Zool. Mus. Berlin 10:347-348, 1922; type species *Tabanus rusticus* Linnaeus.

**Female.** Length 8-15 mm; of typical tabanine form. Eyes pilose, often with single transverse dark stripe in dried specimens; dorsal postocular fringe of hairs often distinct. Frons moderately dimensioned; height-basal width index 2.1 to 4.3, only moderately, if at all, widened above; basal and median denuded calli, when present, distinctly less than width of frons, usually no more than half the width. Ocelli, or their remnants, absent. Antenna yellow; scape and pedicel paler than flagellum, with yellow and black hair; basal flagellomere with obtuse dorsal angle and no more than shallow dorsal excavation. Second palpomere creamy-white, moderately swollen basally, tapered apically, with black and white hair usually uniformly mixed on lateral surface.

Thorax with dark integument, extensively to completely covered with whitish to brownish pruinosity, the former especially on pleural regions and coxae which are also almost exclusively white or yellow-haired; remaining leg segments predominantly yellow to orange with apex of fore tibia, fore tarsi and bases of mid and hind femora usually darkened. Halter yellow to orange, knob sometimes moderately darkened. Wing mostly hyaline; only costal, humeral, and stem cells<sup>1</sup> usually infuscated.

Abdomen with integument usually more or less yellow to orange laterally and with variable pattern of pale and dark hairs or completely pale-haired.

**Male.** Differs from female as follows: head holoptic; eye with upper median area, exclusive of narrow dorsal and lateral margin, with enlarged ommatidia; eye pilosity longer and denser; postocular fringe of hairs usually longer; basal flagellomere of antenna usually more slender; second palpomere oval; femora usually more extensively darkened; body hairs significantly longer and often arranged in quite different pattern on abdomen.

**Mature larva.** Distinguishable from all but a few species of *Tabanus* L. in having pubescent markings on median lateral surface of anal segment, and this segment and the terminal respiratory siphon each being no longer than their greatest diameter.

**Pupa.** Distinguishable also from all but a few species of *Tabanus* by the dorsal and lateral tubercles of terminal aster being inclined dorsoposteriorly on same plane, so that, in lateral view, dorsal tubercles hidden by laterals or lateral tubercles inclined more than dorsals.

<sup>1</sup>Stem cell is based of basal cells (br and bm) and behind base of radius (stem vein of some writers). Other morphological terminology follows the Manual of Nearctic Diptera, Vol. 1, 1981.

KEY TO *ATYLOTUS* FEMALES

1. Frons with glossy basal and median calli, or only a basal callus, neither more than about half width of frons . . . . . 2  
     Frons completely pruinose, without denuded calli . . . . . 7
2. Body hairs almost completely white; black hairs only on antennae, palps, notopleural lobes and tibiae and tarsi. Costal cell concolorous with wing membrane elsewhere . . . . . *utahensis* (Rowe and Knowlton)  
     Black hairs present additionally on frons and dorsum of thorax and abdomen. Costal cell color variable . . . . . 3
3. Nearly lateral third of abdominal tergites orange and prominently outlining a median black stripe . . . . . *woodi* Pechuman  
     Abdomen not as broadly orange laterally . . . . . 4
4. Pale hairs on at least scutum and abdomen distinctly yellow . . . . . 5  
     Pale hairs on all parts of body white to creamy-white . . . . . 6
5. Thoracic pleural hairs yellow. Postocular fringe of hairs long (0.25 mm) and black . . . . . *tingaureus* (Philip)  
     Thoracic pleural hairs white. Postocular fringe of hairs relatively short (0.125 mm) and including many white hairs . . . . . *intermedius* (Walker) (in part)
6. Abdominal coloration in unrubbed specimens greyish as a result of larger median and sublateral white-haired patches on each tergite. Fork of R 4+5 usually with long spur vein. Apical flagellomeres darker than basal flagellomere . . . . . *calcar* Teskey  
     Abdominal coloration dominantly black with little evidence of median and sublateral paler areas on tergites. Fork of R 4+5 with no more than short spur vein. Flagellum usually uniformly yellow . . . . . *insuetus* (Osten Sacken)
7. Pleural hairs bright yellow; basal flagellomere about as broad as long . . . . . *bicolor* (Wiedemann)  
     Pleural hairs white; basal flagellomere usually longer than broad . . . . . 8
8. Pale hairs on scutum and abdomen white and concolorous with thoracic pleural hairs . . . . . 9  
     Pale hairs of scutum and / or abdomen, or calypteral hair tuft, at least faintly yellow and contrasting with white thoracic pleural hairs . . . . . 10
9. Postocular fringe of hairs mostly black . . . . . *sublunaticornis* (Zett.)  
     Postocular fringe of hairs white . . . . . *ohioensis* (Hine)
10. Scutum and dorsum of abdomen completely pale-haired or with sparse black hairs; rather sparse black hairs on palps and notopleural lobe . . . . . *thoracicus* (Hine)  
     Rather prominent black hair on scutum, dorsum of abdomen, palps and notopleural lobe . . . . . 11
11. Costal and humeral cells hyaline; notopleural lobe yellow; postocular fringe usually extensively yellow . . . . . *hyalicosta* n.sp.  
     Costal and humeral cells tinted and contrasting with hyaline membrane elsewhere, postocular fringe usually predominantly black . . . . . 12
12. Abdominal tergites 2 to 4 entirely black-haired medially with at most a caudal fringe of yellow hairs. Upper surface of veins R1, Sc and C with extensively yellow setae . . . . . *dulx* (Walker)  
     Abdominal tergites 2 to 4 with yellow hairs medially, either generally mixed with black hairs or forming rather distinctive patches of dominant yellow hair. Upper surface of anterior wing veins usually with predominantly black setae . . . . . 13
13. Abdominal tergites 2 to 4, or 5 with discrete median triangles of bright yellow hairs based posteriorly, and flanked on either side by submedian anterior patches of exclusively black hair, the pattern visible to the naked eye . . . . . *palus* n.sp.  
     Pale hairs on tergites not bright yellow and not arranged in distinct median triangles, but rather generally mixed with black hairs medially . . . . . 14

14. Length 12 mm or more ..... *intermedius* (Walker) (in part)  
 Length rarely more than 11 mm ..... *sphagnicolus* n.sp.

KEY TO *ATYLOTUS* MALES

1. Postocular fringe of hairs short, little if any longer than eye hairs ..... 2  
 Postocular fringe of hairs much longer than eye hairs ..... 5
2. Body hairs, especially on abdomen, almost completely white; sparse black hairs only on antenna, palp, notopleural lobe, scutum, tibia and tarsus  
 ..... *utahensis* (Rowe and Knowlton)  
 Pale body hairs not necessarily white, and black hairs more abundant and present additionally on frons and abdominal tergites ..... 3
3. About lateral third of first six abdominal tergites orange, and providing sharp margin to median black stripe. Legs almost entirely orange ..... *woodi* Pechuman  
 Orange markings on sides of abdomen much less extensive, or in the form of sublateral spots, especially on tergites 3 and 4, and usually not sharply outlining median black area. Femora extensively blackened ..... 4
4. Fork of R 4+5 with long spur vein. Terminal flagellomeres black and contrasting with orange basal flagellomere ..... *calcar* Teskey  
 Fork of R 4+5 with no more than very short spur vein, but usually lacking. Terminal and basal flagellomeres usually concolorous ..... *insuetus* (Osten Sacken)
5. Thoracic pleural hairs at least partially yellow ..... 6  
 Thoracic pleural hairs completely white ..... 9
6. Almost all body hairs yellow, including wing setae and postocular fringe  
 ..... *bicolor* (Wiedemann)  
 Abundant black hair in postocular fringe and mixed with pale hairs on scutum and abdominal tergites ..... 7
7. All pleural hairs more or less yellow; sides of abdominal tergites at most very narrowly orange. Western species ..... *tingaureus* (Philip)  
 Only those hairs on mesanepisternum and sometimes laterotergite yellow, remainder white; about lateral one quarter of tergites 1 to 3 orange. Eastern species .. 8
8. Flagellum of antenna about four times as long as greatest width of basal flagellomere; latter with distinct dorsal excision. Eye hairs about 0.125 mm long. Length of body 12-13 mm ..... *intermedius* (Walker)  
 Flagellum of antenna about three times as long as greatest width of basal flagellomere; latter without dorsal excision. Eye hairs about 0.08 mm long. Length of body 10-11 mm ..... *palus* n.sp.
9. All pale hairs on body white and concolorous with thoracic pleural hairs ..... 10  
 Pale hairs on scutum and abdomen yellowish and contrasting with white thoracic pleural hairs ..... 11
10. Almost all body hairs white; black hairs restricted to legs, notopleural lobes and palps ..... *ohioensis* (Hine)  
 Black hairs abundant on most areas of body ..... *sublunaticornis* (Zett.)
11. Postocular fringe of hairs predominantly yellow ..... 12  
 Postocular fringe of hairs predominantly black ..... 13
12. Costal, humeral and stem cells hyaline. Notopleural lobe yellow or paler than scutum. Wing veins C and R1 with abundant black setae ..... *hyalicosta* n.sp.  
 Costal, humeral and stem cells infuscated. Notopleural lobe as dark as scutum. Wing veins C and R1 with only yellow setae ..... *duplex* (Walker)
13. Yellow hairs dominant on scutum and dorsally on abdomen, black hairs inconspicuous on these areas and also relatively sparse on notopleural lobe and palps  
 ..... *thoracicus* (Hine)  
 Black hair abundant on palp, scutum, notopleural lobe and dorsally on abdomen  
 ..... *sphagnicolus* n.sp.

KEY TO *ATYLOTUS* LARVAE

Larvae and pupae of *Atylotus* are not distinguishable as a group from all species of *Tabanus*. To maintain emphasis on this close similarity it is preferable to present the following keys as modifications to the keys to larvae and pupae of *Tabanus* and *Atylotus* given by Teskey (1969). The lead couplet number is the same in both keys. A number in brackets after a couplet number is that couplet in the 1969 key that leads to this place. Names or letter designations in brackets before the species names are the identifications applied to these taxa in the 1969 publication.

- 17 (16). Prothoracic anterior pubescent annulus lacking lateral caudal projections. Pubescence absent from anterior margin of meso- and metathorax or faintly evident only laterally on metathorax ..... 18
  - Prothoracic anterior pubescent annulus with slender paired lateral caudal projections. Anterior margins of meso- and metathorax with pubescent annuli ..... 19
- 18. Anal segment with median lateral pubescent patches above but separate from, the pubescence on the anal ridges (Fig. 3) ..... *A. palus* n.sp.
  - Anal segment lacking median lateral pubescent patches above the pubescence clothing the anal ridges ..... (duplex) *A. sublunaticornis* (Zett.)
- 19. Posterior pubescence encircles preanal segment. Usually three small pubescent spots on each lateral surface of anal segment ..... *A. bicolor* (Wied.)
  - Posterior pubescence narrowly absent laterally on preanal segment. Normally only two small pubescent patches on each lateral surface of anal segment ..... (sp. A) *A. hyalicoستا* n.sp.
- 20. (10). Anterior pubescence encircles meso- and metathorax ..... 21
  - Anterior pubescence on meso- and metathorax interrupted dorsally and ventrally ..... (sp. C.) *A. woodi*
  - Pechuman (eastern N.A.) and *A. insuetus* (Osten Sacken) (western N.A.)
- 21. Midlateral caudal projection from median pubescent figure on anal segment united with posterior annulus ..... 22
  - Midlateral caudal projection from median pubescent figure on anal segment not reaching posterior annulus ..... 23
- 22. Lateral pubescent projections from anterior annuli on meso- and metathorax extending caudally  $\frac{2}{3}$  and  $\frac{1}{2}$  length of segments respectively.
  - Anterior and pseudopodial pubescence separated laterally and ventrally. Mature larva about 20 mm long ..... *A. calcar* Teskey
  - Lateral pubescent projections from anterior annuli on meso- and metathorax extending caudally  $\frac{1}{2}$  and  $\frac{1}{3}$  lengths of segments respectively.
    - Anterior and pseudopodial pubescence running together laterally and ventrally. Mature larva 12-15 mm long ..... *Tabanus sparus* Whitney
- 23. Anal segment and respiratory siphon slightly longer than their greatest diameters. Each tracheal trunk approximately 0.6 mm in diameter in preanal segment and tapering abruptly near first abdominal segment. Saltmarsh species ..... *Tabanus nigrovittatus* Macquart
  - Anal segment appearing swollen, length of it and of respiratory siphon equal to or shorter than their greatest diameters. Each tracheal trunk not over 0.4 mm in diameter in preanal segment and tapering gradually anteriorly. Fresh water species .... 24
- 24. Posterior pubescence present on last five to seven segments and encircling the last three to five segments ..... 25
- 25. Posterior pubescence present on no more than last four segments and usually encircling the last two segments ..... 27
  - Prothoracic anterior pubescent annuli with lateral caudal projections expanded apically. Pubescence elsewhere moderately dark ..... 26
  - Prothoracic anterior pubescent annuli with lateral caudal projections slender and tapered apically ..... *A. thoracicus* (Hine)

- 26. Posterior pubescence present on segments 5 to 11, and encircling last five segments.  
Dorsolateral extension of pubescence from anal ridges narrowly connected ventrolaterally to posterior pubescence on segment 10 (Fig. 4) *A. sphagnicolus* n.sp.  
Posterior pubescence present on segments 7 to 11, and encircling the last four segments.  
Dorsolateral extension of pubescence from anal ridges not connected to posterior pubescence on segment 10 ..... *A. ohioensis* Hine
- 27. Striations absent from entire dorsal and ventral surfaces of thoracic segments. Anterior and pseudopodial pubescence connected only ventrolaterally on first 4 or 5 abdominal segments. Larvae normally inhabit damp semiarable soils  
..... *Tabanus quinquevittatus* Wied.  
Striations absent only from dorsal and ventral discal surfaces of thoracic segments.  
Anterior and pseudopodial pubescence connected both dorsolaterally and ventrolaterally on first 6 segments ..... (pematicus) - *A. duplex* (Walker)

KEY TO *ATYLOTUS* PUPAE

- 18. (1). Fringe spines absent from lateral third to half of second abdominal sternite . . .19  
Fringe of spines nearly or completely traversing second abdominal sternite . . . . .23
- 19. Integument of nearly uniform color . . . . .20  
Portions of head and dorsum of thorax distinctly darker than other areas . . . . .21
- 20. Thoracic spiracles at least 0.5 mm long. Antennal ridges prominent and elevated about 0.15 mm above median cleft . . . . . *A. bicolor* (Wiedemann)  
Thoracic spiracles no longer than 0.4 mm. Antennal ridges represented by a low rugose area elevated no more than 0.05 mm . . . . . *A. thoracicus* (Hine)
- 21. Antennal ridges in form of areas of weak rugosity. Abdominal fringe spines on posterior tergites showing almost no differentiation into anterior and posterior series either in relative length or spatial separation . . . . . *A. sphagnicolus* n.sp.  
Antennal ridges well developed, with distinct crest. Abdominal fringes on posterior tergites with longer spines posteriorly in fringes and shorter spines anteriorly . . . . .22
- 22. Pupa 16 to 19 mm long . . . . . (sp. A) *A. hyalycosta* n.sp.  
Pupa 14 to 16 mm long . . . . . (pematicus) *A. duplex* (Walker)
- 23. Thoracic spiracles no longer than 0.5 mm and spiracular prominences not exceeding anterior dorsal margin of thorax . . . . .24  
Thoracic spiracles 0.6-0.8 mm long and spiracular prominences exceeding anterior dorsal margin of thorax by about 0.2 mm  
..... *Tabanus similis* Macquart, *T. lineola* Fabricius
- 24. Fringes of spines, especially on more posterior abdominal segments, distinctly differentiated into two series by angle of incline of spines, those posteriorly in each fringe reclining posteriorly and those spines more anterior in fringe erect, the two series usually well spaced . . . . .25  
Spines in fringes on more posterior abdominal segments all projecting at about the same angle . . . . .27
- 25. Pupal integument almost uniformly pale yellowish brown. Antennal and frontal ridges, or the areas they normally occupy, of about equal elevation and prominence . . . . .26  
Portions of head, and dorsum of thorax darker than remainder of integument  
..... *A. insuetus* (Osten Sacken)
- 26. Thoracic spiracles 0.3 mm long . . . . . (duplex) *A. sublunaticornis* (Zett.)  
Thoracic spiracles 0.4-0.5 mm long . . . . . (sp.C) *A. woodi* Pechuman
- 27. Pupa no longer than 16 mm. Thoracic spiracles 0.3-0.4 mm long  
..... *A. palus* n.sp., *A. ohioensis* (Hine)  
Pupa about 20 mm long. Thoracic spiracles at least 0.5 mm long . . *A. calcar* Teskey

*Atylotus bicolor* (Wiedemann)

*Tabanus bicolor* Wiedemann 1821:46

*Tabanus fulvescens* Walker 1848:171

*Tabanus ruficeps* Macquart 1855:55

**Female.** Length 8 - 11 mm. Head integument predominantly yellow to light brown pruinose with black and yellow hair on frons, mostly yellow-haired elsewhere, except postocular fringe sometimes with sparse black hair. Frons 2.9-3.6 times as long as basal width, usually slightly widened above. Antenna yellow, scape and often pedicel with black hair mixed with the yellow; basal flagellomere nearly as wide as long, with at most only shallow dorsal excision, longer than terminal flagellomeres. Second palpomere yellow, with yellow and black hairs; moderately swollen basally (2.5 - 3.1 times as long as greatest diameter). Eye sometimes with partial to nearly complete dark transverse stripe.

Thorax mostly dark brown pruinose on scutum, with erect black hairs and more recumbent yellow hairs; notopleural and postpronotal lobes yellow, former with yellow and black hair; pleura greyish pruinose with yellow hair concolorous to that on other parts of body. Legs, except sometimes parts of mid and hind coxae yellow, mostly yellow-haired, with black hairs predominantly on tibia and tarsi. Wing with costal, humeral and stem cells almost hyaline to distinctly yellowish infuscated; anterior wing veins with yellow setae. Halter yellow.

Abdomen dorsally predominantly dark brown with sides of first 3 to 6 tergites distinctly more yellow; sternites mostly yellow; hairing of tergites yellow and black, yellow hairs uniformly distributed, black hair confined more to middle of tergites, especially on tergite 2; sternites completely yellow-haired.

**Male.** Apart from usual sexual differences, differs from female as follows: postocular fringe of longer yellow hairs; antenna and palpi frequently without black hair; thorax with long yellow hairs on scutum, black hairs inconspicuous; legs with yellow hair more dominant on distal segments; abdomen more broadly yellow laterally, with dark brownish median stripe widest anteriorly and usually no more than one-third the width of abdomen.

**Mature larva and pupa.** Described by Teskey (1969).

**Specimens examined.** 81♀, 91♂ (not including types) from localities plotted in Fig. 1.

**Remarks.** Adults of this species are distinctive from other *Atylotus* by all pale hairs, including those on the pleural surfaces of the thorax being yellow.

*Atylotus duplex* (Walker)

*Atylotus pemeticus* of some authors, not Johnson.

*Tabanus duplex* Walker, 1854:173 (new name for *imitans* Walker).

*Tabanus imitans* Walker, 1848:173 (preocc., Walker, 1848:146).

**Female.** Length 9-12 mm. Predominantly dark brown or black. Eye very sparsely, short pilose, yellow brown to reddish in dried specimens, usually lacking any vestige of a transverse stripe. Postocular fringe of hairs usually extensively black, rarely completely yellow. Frons, subcallus and upper parts of genae yellow to tawny pruinose; the former with yellow and sparse black hair; sides of subcallus with few hairs; genae and clypeus usually with pale hairs only; underlying integument, except medially on frons, yellow; frons 3.4-4.0 times as long as basal width, nearly parallel-sided. Basal flagellomere 1.1-1.4 times as long as greatest width, with obtuse dorsal angle and usually slight dorsal excavation; apical flagellomeres about as long as width of basal flagellomere. Second palpomere 2.1-3.0 times as long as greatest width.

Thorax black with white pruinosity and white hairs on pleura and coxae and faintly brownish pruinosity with recumbent yellow hairs and more erect black hairs on scutum and scutellum. Legs except coxae, mostly orange with base of mid and hind femora often darkened. Wing with costal, humeral, and usually stem cells tinted; setae dorsally on C, Sc, R1 and basicosta usually predominantly yellow; calypterale tuft of hairs yellow. Halter yellowish-orange.

Abdomen dorsally mostly dark brown with lateral quarter or less of first two tergites and narrow lateral margins of remaining tergites yellowish; these areas mostly with concolorous hairs, except that caudal margins of tergites with fringe of yellow hairs, which medially may encroach sparsely into middle of tergites, while black hairs may extend laterally onto yellow sides of tergite 2. Sternites dark with greyish pruinosity and yellow hairs except for a few black hairs on caudal segments.

**Male.** Apart from usual sexual differences, the most dimorphic of any species of the genus; postocular fringe of long completely yellow hairs; thoracic hairing longer, predominantly yellow on scutum, with black hairs most distinct on notopleural lobes; wing with anterior vein setation completely yellow; abdomen with integument of as much as lateral  $\frac{1}{2}$  to  $\frac{2}{3}$  of anterior tergites yellow; tergites predominantly long yellow-haired, with black hairs rather inconspicuous medially; sternites usually yellowish-orange laterally.

**Mature larva and pupa.** Described by Teskey (1969) under the name of *pematicus*. These larvae were found in wet moss in woodland swamps and spring-fed drainage beds.

**Specimens examined.** 110 ♀♀, 64 ♂♂, including the lectotype ♀ and paralectotype ♂ from St. Martins Falls, Albany River, Hudsons Bay, Canada. The distribution of these are plotted on Fig (2).

**Comments.** Females of this species are quite variable, especially in the color of the postocular fringe of hairs and vein setae and the occasional presence of a well developed eye stripe. Since no concordance has been detected in such variations, they are judged to be of an intraspecific nature. However, this reduces the characteristics for reliable identification to only the hair color pattern on the abdominal tergites.

Males, on the other hand, are relatively uniform in appearance and are quite dimorphic to the females by virtue of their completely yellow postocular fringe and predominantly yellow scutal and abdominal hairs.

The association of sexes which was first made by Walker in selecting his type specimens was confirmed by my rearings. The males are very similar to *hyalicosta* n.sp., differing only in the yellowish costal cell. None have a yellow notopleural lobe as do most males of *hyalicosta*. At the same time, the yellow hairs of the postocular fringe of the male, coupled with the predominantly yellow abdominal tergal hairing and yellow anterior vein setae, clearly negates any conspecificity with other species.

#### *Atylotus palus* n.sp.

**Female.** Length of body 9-11 mm, of wing 7.5-9.5 mm. Eye in dried specimens lacking transverse stripe, very sparsely short pilose. Frons 2.8-3.4 times as long as basal width, parallel-sided to slightly widened above, with underlying integument predominantly dark, covered with grey and brown pruinosity and with yellow and black hair. Vertex and median occipital sclerites usually similarly colored. Postocular fringe of mixed yellow and black hairs. Subcallus with yellow integument covered with yellow pruinosity. Clypeus and gena with predominantly dark integument covered by greyish to brown pruinosity and mainly yellow hairs, with a few black hairs on upper part of gena. Antenna with basal flagellomere  $\frac{1}{3}$  to  $\frac{1}{2}$  longer than greatest width with obtuse dorsal angle and little or no dorsal excavation; apical flagellomeres about as long as greatest width of basal flagellomere. Second palpomere creamy-



white, 2.1-2.6 times as long as greatest diameter, tapering to acute point, with slight subapical constriction and predominantly black hair.

Thorax, including coxae, with black integument, overlaid on pleura and coxae with whitish pruinosity and white hairs; scutum with brownish pruinosity and bright yellow recumbent hairs and sparser more erect black hairs. Legs mostly yellow to orange with bases of mid and hind femora, apex of fore tibia, and fore tarsi darkened. Wing membrane hyaline except for yellowing of costal, humeral, and stem cells; C., Sc and R<sub>1</sub> with predominantly black setae, yellow setae confined to anterior margin of C. Calypter hair tuft yellow. Halter orange.

Abdominal ground color predominantly brownish-black but often with lateral  $\frac{1}{4}$  to  $\frac{1}{3}$  of first two or three tergites more or less distinctly yellow; all tergites usually with bright yellow and black hair in a fairly consistent pattern, with yellow hair generally dominant laterally, on posterior margins, and in median, posteriorly based, triangles nearly or quite crossing tergites; black hair forming submedian anterior inverted triangles bordering the median ones, with some mixing of hair colors sublaterally. Some specimens with tergites almost completely yellow-haired. Sternites almost completely pale yellow-haired with some sparse, erect black hair on terminal segments.

**Male.** Apart from normal sexual differences, differing from female in having predominantly black or orange-tinted postocular fringe with yellow hairs largely confined to central ocellar tubercle area. Eye hairs less dense than in other species and no more than 0.1 mm long. Mesanepisternum and sometimes laterotergite with conspicuous yellow hairs. Black hair on abdominal tergites generally distributed and dominant over all except extreme lateral and posterior margins of tergites, which are exclusively yellow-haired, but mixed with yellow hair on sublateral areas of yellow integument and in median triangular intrusions of sparse yellow hair toward middle of tergites from posterior marginal yellow hair fringes.

**Mature larva** (Fig. 3). Creamy-white, approximately 18 mm long. Head capsule 1.9-3.4 mm long. Tracheal trunks slender. Anal segment subspherical, about as long as greatest diameter. Respiratory siphon length about equal to basal diameter. Integumental striations moderately prominent on all aspects of body except dorsal and ventral discal surfaces of thoracic segments. Pubescence present on all but mesothorax and usually metathorax. Anterior pubescence encircles prothorax and first four to six abdominal segments but absent laterally on abdominal segment 7 and usually on preceding two segments; metathorax sometimes with faint pubescence antero-laterally. Pseudopodial pubescence encircles first six abdominal segments; usually absent between dorsal and lateral pseudopodia on seventh abdominal segment; distinctly united with anterior pubescence only ventrolaterally, the two areas of pubescence only closely approaching a union dorsolaterally. Posterior pubescence narrowly encircles anal and preanal segments and restricted to dorsal and sometimes ventrolateral posterior margin of abdominal segment 6. Anal segment additionally with small, usually isolated, patches of pubescence midlaterally and dorsolaterally above short upward extension of pubescence on anal ridges; latter sometimes narrowly meeting midlateral spot.

**Pupa.** Length 24-25 mm. Empty exuvium almost brown with only the intersegmental membrane of abdominal segments showing slight contrast in colortone. Antennal ridges relatively prominent, rounded on leading edge, elevated about 0.10 mm above median cleft. Frontal tubercles in form of several low corrugated ridges between outer extremities of antennal ridges. Callus tubercles elevated about 0.1 mm. Thoracic spiracles 0.3 mm long, gently bowed; spiracular prominence not exceeding anterior margin of thorax. Abdominal fringes of spines traversing usual sclerites, uniseriate on all sternites except sternite 7 and anterior one or two pleurites and tergites, more or less distinctly biseriate elsewhere with distinction being as much in length of spines as in spatial separation; spines anteriorly in fringes generally shorter than more posterior spines, and spines of both series projecting at same angle. Fringe of tergum

7 with 40-55 spines, longest approximately 0.6 mm. Dorsal, lateral and ventral tubercles of aster about 0.25, 0.5 and 0.2 mm respectively; former two pairs inclined dorsoposteriorly on the same plane.

**Type Specimens.** Holotype ♀, Highland Rd., Mi. 15, Victoria Co., Nova Scotia, 23-28-VII-1978, G.B. Fairchild (trap in grassy bog). Deposited in Florida State Collection of Arthropods (F.S.C.A.); allotype ♂, same data except 27.VII-1.VIII.78; Paratypes 59 ♀♀, 13 ♂♂, including 18 ♀♀ and 5 ♂♂ from type locality, from localities plotted on Fig 5. One of these locations, Puslinch, Ontario, yielded larvae from which 2 ♀♀ and 4 ♂♂ were reared. This locality, an alkaline or marl bog, was described by Teskey (1969) in connection with his description of the immature stages of *Atylotus* sp. C.

Paratypes are deposited in Univ. Fla., C.N.C., Cornell Univ., M.C.Z., Nova Scotia Prov. Mus., Univ. Kansas and personal collection of A.W. Thomas.

The specific name is the latin word for marsh, bog, fen and swamp, of which the term "fen", as defined by Tarnocai (1980) fits the larval habitat most closely.

**Comments.** Larvae of this species closely resemble those of *A. sublunaticornis* (Zett.) which were described and illustrated by Teskey (1969) under the name of *duplex*. These two are the only known *Atylotus* species lacking complete anterior pubescent annuli on the meso and metathorax. The larva of this species differs from that of *sublunaticornis* in having pubescent markings on the median lateral surfaces of the anal segment and on the posterior of abdominal segment 6.

Pupae of *palus* will run to couplet 21 in the key provided in the above publication but exhibit only one of the two characters of each of the two species exiting there. Of these two, *thoracicus* and sp. A, greatest similarity is with the latter, here described and named *A. hyalicosta*. Possibly the only significant difference is the greater length of *hyalicosta*, at 16-19 mm, and its larger antennal ridges.

Adults, especially females, resemble *A. sphagnicolus* n.sp., some so closely that a question of their conspecificity might be considered. However, the consistent difference in the length of the eye hairs and color of the mesanepisternal hairs of males and the very great differences in the immature stages should dispel this possibility. Additionally, the preferred breeding sites of the two species are quite different, this species apparently restricted to neutral or alkaline wetlands while *sphagnicolus* appears to be partial to sphagnum bogs.

Most females of *palus* can be distinguished by the brighter yellow abdominal hairs and the more distinctive median triangles of yellow hair on the tergites.

#### *Atylotus hyalicosta* n.sp.

**Female.** Length 10-12 mm. Eye with narrow transverse reddish-brown stripe in dried specimens; postocular fringe of hairs usually predominantly yellow. Frons 3.2-4.1 times as long as basal width, nearly parallel-sided; underlying integument with blackish median elliptical area bordered by yellowish integument, with the whole covered by brownish pruinosity and short inconspicuous yellow and black hair. Subcallus yellowish, pruinose. Antenna with basal flagellomere 1.1 to 1.5 times as long as greatest width with, obtuse dorsal angle and no dorsal incision. Clypeus and genae mostly white pruinose, white-haired, except upper part of genae brownish-tinged. Second palpomere pale yellow 2.0-3.5 times as long as greatest width, predominantly black-haired.

Thorax blackish except for yellow to reddish notopleural and supraalar lobes; scutum and scutellum with recumbent orange to pale yellow hairs and erect black hairs, latter most conspicuous on notopleural lobes; pleura, and coxae whitish pruinose, white-haired. Legs

mostly yellowish-orange to pale brown. Halter yellow. Wing membrane, including costal cell, hyaline; calypteral hair tuft usually white. Setae on anterior wing veins usually predominantly black, occasionally mostly yellow.

Abdomen dorsally mostly dark-brown to black with sides of tergites more or less yellow, this yellowing most extensive on tergite 2 and sometimes comprising two-thirds width of segment but reduced on preceding and following tergites; yellow hair exclusively present on lateral and caudal margins and sometimes nearly evenly mixed with black hairs anteromedially, or black hairs dominant in latter areas. Sternites predominantly to completely black in ground color and white-haired, except for sparse black hair on sternites 6 or 7.

**Male.** Apart from usual sexual differences, differs from female as follows: postocular fringe of hairs long, mostly white to yellow, occasionally a bronze color; pale hairs on scutum and abdomen usually yellow to off-white but sometimes as white as pleural hairs; notopleural lobe sometimes dark; black hair almost absent on scutum and often very sparse on abdomen. Setae on anterior wing veins predominantly to completely yellow.

**Mature larva and pupa.** Described as *Atylotus* sp. A by Teskey (1969).

**Type Specimens.** Holotype ♀, Capreol, Ontario. 3.III.64, H.J. Teskey, specimen reared (No. 63-11-2) with associated larval and pupal exuvia; Canadian National Collection No. 18146. Allotype ♂ with same data but 25.VI.63 and also reared (No. 63-11-2); paratypes 82 ♀♀, 69 ♂♂ from localities plotted on Fig. (6). Paratypes deposited in C.N.C.; Cornell Univ., Florida S.C.A., U.S.N.M., M.C.Z., Cal. Acad. and Universities of Mich., Minn., Montreal, Kansas, Ohio S., W. Virginia and the personal collection of Dr. A.W. Thomas.

**Comments.** This is another rather variable species in integumental and hair coloring. This variation is seen in reared specimens even from the same locality. The most distinctive diagnostic features are the yellowish notopleural lobe and hyaline costal cell. One feature or both alone, or preferably combined with predominantly pale postocular hairs, some trace of an eye stripe, and the presence of some yellow hairs on all aspects of the abdominal tergites, will usually provide a reliable identification.

The dark abdominal hairing was seen only in some western Canadian material, including specimens from Alberta that were reared by Dr. A.W. Thomas. That this is merely intraspecific variation seems assured since the adults and immature stages conform closely in all other respects.

### *Atylotus intermedius* (Walker)

*Tabanus intermedius* Walker, 1848:173.

*Tabanus incisuralis* of some authors, not Macquart, in reference to eastern N.A. specimens.

*Tabanus pemeticus* Johnson, 1921:11 new synonymy.

**Female.** Length 14 mm. Eye orange-brown when dried, with transverse narrow reddish stripe from inner angle extending  $\frac{1}{2}$  to  $\frac{2}{3}$  width of eye; sparsely short pilose. Postocular fringe of hairs short, predominantly yellow. Frons 3.6 times as long as basal width, parallel-sided; mostly black covered by greyish to brown pruinosity and yellow and black hair, sometimes with subspherical, denuded brownish basal callus being less than half width of frons, and ragged linear black median callus. Subcallus yellowish-brown, pruinose. Clypeus and gena mainly black in ground color, covered with white pruinosity, brownish tinged on upper margin of genae and mostly white-haired. Antenna with scape and pedicel yellow with black and yellow hairs, flagellum orange; basal flagellomere 1.6 times as long as broad, with obtuse dorsal angle and very shallow dorsal excavation; terminal flagellomeres almost as long as basal flagellomere. Second palpomere creamy-white with black and white hair, 2.5 times longer than basal width, concavely tapered apically.

Scutum and scutellum mainly black, notopleural lobe and postalar and supra-alar lobes more or less orange, with yellowish recumbent hairs dominant over sparse, erect, black hairs, except on notopleural lobes. Pleura and coxae black, covered with white pruinosity and completely white-haired; remainder of legs mostly orange. Halter orange. Wing with costal cell yellow; furcation of R 4+5 with short spur vein; setae on anterior wing veins predominantly black; calypteral hair tuft yellow.

Abdomen dorsally greyish-brown pruinose over mostly dark integument, only posterolateral corner of tergum 1 and narrow reflexed sides of other tergites yellow; tergite 1 with predominantly yellow hair concentrated laterally, on posterior margins, and in median triangles that narrow anteriorly, with black hairs dominant elsewhere, but with much intermixing along adjacent margins, making distributional patterns vague. Sternites greyish pruinose with predominantly yellowish-white hairs and sparse black hairs medially.

**Male.** Similar to female except for sexual differences and: postocular fringe with long yellow and black hairs and ocellar tubercle predominantly yellow-haired. Second palpomere suboval, pointed apically, yellowish, with yellow and black hairs. Genae completely yellow-haired. Scutum with long, predominantly yellowish hairs; pleura with long white hairs, except hair tufts on anepisternum and laterotergite yellowish. Legs with bases of femora dark brown to black. Abdominal tergites more broadly yellowish laterally, and dominantly yellow haired laterally and on posterior margins, but black and white hairs mixed elsewhere.

**Immature stages.** Unknown

**Specimens examined.** ONTARIO: Lectotype ♀ and paralectotype ♂, St. Martins Falls, Albany River (in B.M.N.H.); 1 ♀ Rushing River Prov. Pk., Kenora, 11-VIII.70, J.R. Powers; 1 ♂, Low Bush, Lake Abitibi, 17.VIII.23, N.K. Bigelow; MICHIGAN: 1 ♀ 1 ♂, Chippewa Co., 3 mi. W. junc. M28, 18.VIII.75, C.T. Maier; MAINE: 1 ♀, Spectacle Mt., Gilead, 31.VII.36; 1 ♀ Ship Harbor, Mt. Desert Isl., 20.VII.56, F.R. Shaw; 1 ♀, F.A. Eddy (no other data); holotype ♀, allotype, and paratype ♀ of *Atylotus pemeticus* (Johnson) respectively: Southwest Harbor, 20.VIII.20, C.W. Johnson; Northwest Harbor, 22.VIII.18, C.S. Minot; Mt. Cadillac, Mt. Desert, 17.VIII.20, C.W. Johnson.

**Comments.** The minimum length of the above specimens is 12 mm. No specimens of other eastern species of *Atylotus* studies here exceed this size and few reach it. Thus the 13-14 mm length of the type specimens of *A. pemeticus* coupled with their close similarity in almost all other features strongly supports the synonymy with *A. intermedius*. The only difference in the two is the absence of basal and median calli in the holotype of *pemeticus*. The Mt. Desert paratype of *pemeticus* and other Maine specimens listed above have very small basal calli with ragged uneven edges and, in one specimen, with pruinosity extending into the middle of the callus, suggesting that the denudation is a product of abrasion. Similar evidence for the origin of the median callus can also be seen. That both forms occur on Mt. Desert Island, Maine and have a common flight period is also indicative of their conspecificity.

### *Atylotus sublunaticornis* (Zetterstedt)

*Tabanus sublunaticornis* Zetterstedt, 1842:118.

*Tabanus plebejus* of some authors, not Fallen, 1817.

*Baikalia vaillanti* Surcouf, 1921:39.

**Female.** Length 9-12 mm. Predominantly black integument with white and black hairs. Eyes short pilose, usually with vestige of single transverse eye stripe in dried specimen. Frons 2.3 to 3.1 times as long as basal width, essentially parallel-sided, dark with areas of white and slightly brown pruinosity, and black and white hairs, former more abundant dorsally. Postocular fringe of hairs black. Subcallus with underlying integument more or less yellow.

Clypeus and genae whitish pruinose with white and black hairs, latter more abundant on genae. Antenna with basal flagellomere  $\frac{2}{3}$  to  $\frac{3}{4}$  as wide as long, with obtuse dorsal angle and little or no dorsal excavation; terminal flagellomeres equal to, or longer than greatest width of basal flagellomere. Second palpomere 2.2 to 3.2 times as long as greatest diameter, evenly tapered or acuminate apically.

Thorax and coxae white pruinose; scutum and scutellum with more or less recumbent white hair and erect black hair; pleura and coxae with longer erect white hair; remaining leg segments yellow, darkening at apex of fore tibia and tarsus and on base of mid and hind femora, with mostly black hair except on mid and hind femora. Wing with calypteral hair tuft white; wing membrane hyaline; anterior vein setae exclusively black. Halter stem yellow with knob brownish.

Abdomen dark, with sides of tergites narrowly yellow, more extensively so on sides of tergites 1 and 2; tergites with black and white hair, white hair on tergites confined to lateral margins, and posterior marginal fringes with sublateral patches of white hair intruding from margin into middle of tergites, latter especially evident on tergites 2 and 3; sternites with mostly white hair and only a few sparse long black hair medially.

**Male.** Apart from usual sexual differences, differing from female as follows: abdominal tergites usually more broadly yellow laterally, with this color sometimes extending to tergite 4; white hairing on tergites often more extensive covering lateral third of tergites.

**Mature larva and pupa.** Described and illustrated by Teskey (1969) under the name of *Atylotus duplex* and also by Jezek (1977).

**Specimens examined.** 28 ♀♀, 32 ♂♂, from localities plotted on Fig. (7) and 2 ♀♀, 5 ♂♂ from Abisko, Sweden and Murnauer, Germany. Specimens deposited in C.N.C., Cornell Univ., Univ. Minnesota, Ohio State Univ., Calif. Acad. Sci.

**Remarks.** The European adults of *Atylotus sublunaticornis* that were examined, and descriptions of this species given by Olsufjev (1977) and Chvala, Lyneborg and Moucha (1972), are clearly the same as the above Nearctic specimens. Larvae of the Palaearctic form, described by Jezek (1977), differed from Nearctic specimens in the absence of pubescence on the anterior margins of the meso- and metathorax.

This species and *ohioensis* are the only known solely white- and black-haired forms. All others, except for the occasional specimen of *sphagnicolus*, have some of the pale hairs on the scutum and abdomen at least faintly yellowish and, except for *bicolor*, contrasting with the pure white hairs on the thoracic pleuron. Whereas, in *sublunaticornis* there are abundant black hairs, including the postocular fringe, *ohioensis* is dominantly white-haired.

One specimen of *sublunaticornis* from Doyle, Nfld. has slightly yellow abdominal tergal hairs. That it is merely a variant seems assured, based on similarities in the pattern of pale and black tergal hairs and the white calypteral tuft of hairs. Males collected at the same time have the normal abdominal hair pattern and color and a completely black postocular fringe. In species having normally yellowish abdominal hairs, the postocular fringe is almost invariably partially yellow-haired.

The close similarity of larvae of *sublunaticornis* to those of *palus*, and means of differentiating the two are discussed under the latter species.

The only locality where larvae of this species have been collected is the one at Puslinch, Ontario that has also yielded *Atylotus palus* and *A. hyalicosta* described here, and *A. woodi* described by Pechuman (1981). The habitat was briefly described by Teskey (1969) and seems to correspond closely to what is classified as a fen by Tarnocai (1980).

*Atylotus ohioensis* (Hine)

*Tabanus pruinosus* Hine, 1900:248 (preocc. Bigot, 1892).

*Tabanus ohioensis* Hine, 1901:28 (new name for *pruinus* Hine).

**Female.** Length 8-10 mm. Head dark greyish on occiput and genae, more or less yellow on frons, subcallus, frontoclypeus, and upper portion of genae; all covered with whitish pruinosity and white hair, including postocular fringe. Eye usually with partial transverse stripe in dried specimens and relatively long dense pile. Frons 2.3-3.0 times as long as basal width, essentially parallel-sided. Basal flagellomere subquadrate, 1.0-1.3 times as long as greatest width, with dorsal angle obtuse and no dorsal excision; terminal flagellomeres shorter than width of basal flagellomere. Second palpomere swollen basally, 1.9-2.5 times as long as greatest diameter, tapered uniformly to sharp point, mostly white-haired with black hairs mainly on apical half.

Thorax dark, covered with whitish pruinosity and predominantly white hairs, with a few black hairs on notopleura and usually sparsely distributed over scutum. Legs predominantly yellow with coxae and base of femora greyish black. Wing with all membranous areas hyaline. Halter yellow.

Abdomen blackish with pale hairs on tergites and sternites white, such hairs almost exclusively on sternites while on tergites exclusively on more or less of lateral and caudal margins and usually intermixed with dominant black hairs on discal areas of tergites.

**Male.** Apart from usual sexual differences, differs from females as follows: eye with dense long, white pubescence; postocular fringe of long white hair; scape and pedicel of antenna usually completely white-haired or with very sparse black hairs, and basal flagellomere more slender and usually with shallow dorsal excision; thoracic scutal hairs completely white; abdomen with sides of tergites 1 to 3 yellow and all tergites predominantly white-haired including median discal areas.

**Mature larva and pupa.** Described by Teskey (1969).

**Specimens examined.** 38 ♀♀, 39 ♂♂, including syntypes in the U.S.N.M. and Ohio State Univ., distributed as plotted in Fig. (8). One of these syntypes in Ohio State University, a female bearing a handwritten label "Medina, 0.6-27-99", has been selected as lectotype and so labelled on the specimen.

**Comments.** Adults of this species are distinctive by virtue of their smaller size, by all pale hairs, including the postocular fringe and setae on the anterior wing veins of both sexes, being white and by the subquadrate basal flagellomere. Specimens of *Atylotus sublunaticornis* are the only others where the pale hairs are extensively white, but they differ in having the postocular fringe and wing vein setae black, and a more slender basal flagellomere. Members of *Atylotus thoracicus* are actually the most similar, but are readily distinguished by the pale hairs on the scutum and by the abdomen showing at least a slight yellowish tinge which is especially evident in contrast to the white hairs on the thoracic pleuron. Additionally, there are fewer black hairs on the abdominal tergites, notopleural lobes and palpi of *thoracicus*, especially in females, and the integument on the sides of the abdominal tergites is more extensively yellowish.

*Atylotus sphagnicolus* n.sp.

*Atylotus pemeticus* of most authors, not Johnson.

**Female.** Length of body 8-11 mm, of wing 7-9.5 mm, brownish-black in general appearance. Eyes lacking transverse stripe, very sparsely short pilose. Frons 2.8-3.5 times as long as basal width, nearly parallel-sided, with underlying integument usually black medially, bordered

by yellow, and covered with greyish-brown pruinosity and yellow and black hairs. Vertex and median occipital sclerite usually similarly colored. Postocular fringe of predominantly black hair. Subcallus with yellow integument and covering pruinosity. Antenna yellowish; scape and pedicel a paler tone, with yellow and black hairs; basal flagellomere  $\frac{1}{2}$  to  $\frac{1}{2}$  longer than greatest width, with weak dorsal angle and no dorsal excision, about 1.5 times as long as terminal flagellomeres. Second palpomere creamy-white, 2.3-3.7 times as long as greatest diameter, with long, mainly black hair.

Thorax with pleura and coxae white pruinose, white-haired; scutum brownish pruinose with recumbent yellow hair and sparser erect black hair. Leg segments beyond coxae mainly yellow, although base of femora usually darkened. Halter yellowish-orange. Wing with costal, humeral and stem cells yellow-tinted and contrasting with clear membrane elsewhere; anterior wing veins with predominantly black setae; calypteral tuft of hairs usually yellow.

Abdominal integument predominantly brownish-black with sides of first two tergites narrowly yellow; all tergites exclusively very pale to bright yellow-haired laterally and on posterior margins but usually mixed with black hairs elsewhere, but in some specimens with black hair forming dominant or exclusive patches anteriorly or sublaterally near anterior margins of first three or four tergites. Sternum blackish with pale yellow to white hair, with sparse black hair on terminal three visible sternites.

**Male.** Apart from normal sexual differences, differs from female as follows: postocular fringe with long, predominantly black hairs; eye hairs white, very dense and about 1.5 mm long. Femora usually with basal half, or more, blackened. Yellow and black hairs uniformly mixed on abdominal tergites 1 and 2 but on tergites 3 to 5 black hair predominant in anterior and sublateral positions.

**Mature larva** (Fig. 4). Creamy-white, approximately 18 mm long. Head capsule 2.8 mm long. Tracheal trunks slender. Anal segment subspherical, about as long as greatest diameter. Respiratory siphon length about equal to basal diameter. Pubescence present on all segments. Anterior pubescence encircles first eight segments and progressively more widely absent laterally on next two segments and dorsally on tenth segment; thoracic annuli with caudal projections, two clavate projections laterally on each side of prothorax and a midventral pointed projection and four pointed projections on each side of meso- and metathorax, those on mesothorax  $\frac{1}{2}$ - $\frac{2}{3}$  length of segment, those on metathorax very short; annuli on anterior abdominal segments wide laterally, abutting or only narrowly separated from lateral pseudopodia. Pseudopodial pubescence encircles first seven abdominal segments. Posterior pubescence encircles terminal five segments and progressively reduced laterally and ventrally on preceding two segments. Anal segment with median pubescent extension from anal ridges to a dorsolateral position, with two short caudal projections laterally and dorsolaterally.

**Pupa.** Length 15 mm. Integument predominantly light brown with darker median and sublateral areas dorsally on thorax and on vertex of head; a short darker stripe between antennal ridges and three faintly darker longitudinal stripes on frontal plate behind antennal ridges; abdominal tergites brighter and darker than opaque intersegmental areas. Antennal and frontal ridges similar, low rugose areas; former separated by rather wide median cleft. Callus tubercles conical, elevated about 0.06 mm. Thoracic spiracles 0.45 mm long, evenly bowed, mounted on shallow prominences not extending anteriorly beyond thoracic margin. Abdominal spiracles progressively shorter from 0.2 mm for spiracle 1 to 0.09 mm for spiracle 7. Fringes of spines complete on all but lateral third of abdominal sternite 2, spines essentially uniseriate on tergites 1 and 2 and sternites 1 and 6, indistinctly biseriate elsewhere; individual spines slender and acute, progressively larger on posterior segments; tergite 7 with 70 spines, longest about 0.4 mm. Ventral and especially lateral preanal combs with short spines; dorsolateral combs absent. Dorsal, lateral, and ventral tubercles of aster approximately 0.18, 0.4 and 0.18 mm long, respectively, former two pairs inclined dorsally at about same angle and both with apices somewhat hooked ventrally.

**Type specimens.** Holotype ♀, Kouchibouguac National Park, New Brunswick, 20.VII.77, G. A. Calderwood (Code - 5664V), Canadian National Collection No. 18148; allotype ♂, with same data except 28.VI.77 (Code 5444J); paratypes; 132 ♀♀, 107 ♂♂ from localities plotted on Fig. (9). Included in the paratype series is one specimen reared from a larva collected in a sphagnum bog near Alfred, Ontario. Two other, identically reared specimens from the same locality died in the pupal stage. Paratypes are deposited in: C.N.C., U.S.N.M., Cornell Univ., M.C.Z., Cal. Acad. Sci., Nova Scotia Prov. Mus., Univ. Montreal, Ill. Nat. Hist. Surv., Univ. New Hampshire, F.S.C.A. and collection of Dr. A.W. Thomas.

**Comments.** The pale scutal and abdominal hairs among adults of this species vary quite widely in color tone from distinctly yellow to nearly white in all or in part. The latter extreme has been observed particularly in specimens from the northern part of the species range between 45-48° N lat. A conspicuous feature of most of these specimens is a white calyptal tuft of hairs. These features were initially considered of specific significance but the presence of some distinctly yellow-white specimens throughout this zone, including some collected in the same series as the whitish-haired specimens, indicates their conspecificity. This is further confirmed by the probable breeding site of all specimens, representing the entire color spectrum, being acidic sphagnum bogs. The one larva of this species that was reared, yielding a female with white calyptal tuft, was collected in such a bog at Alfred, Ontario. All but one of the adult collection localities of which I have personal knowledge, or have confirmed with the collectors of the specimens, which involves about 60 percent of the localities, were sphagnum bogs.

Another group of variant specimens, tentatively identified as this species, but not included as paratypes, are a species of 19 females collected in a sphagnum bog on the TransCanada Hwy., Victoria Co., Nova Scotia, and 8 other females from Nova Scotia, New Brunswick, Maine and Michigan. These specimens are all at the maximum body size for *sphagnicolus*, with more swollen palps and broader basal flagellomere. Statistical analysis of the dimensions of these structures compared with a similar series of typical specimens of *sphagnicolus* in the same or nearby bogs to the one on the TransCanada Hwy. showed a significant difference at the 95% level. The specimens also differ in having the setae on the anterior wing veins predominantly yellow. Apart from this latter feature these specimens resemble *Atylotus intermedius* as reinterpreted here. However, in addition to the vein setal color difference, there is no indication in any of the specimens of denuded areas on the frons or of small elevations on the frons where natural abrasion might create the glossy calli that are distinctive of most females of *intermedius*. Further collections, including the larvae of this form, and association with males will likely be necessary before the true significance of these variations can be known.

Adults of *Atylotus sphagnicolus* are quite similar to *A. palus* in size, dimensions of frons, palps and flagellum and also in the pattern and coloring of hairs on the body. It is frequently difficult to distinguish the females of the two species. The only difference is the brighter yellow hairs and more prominent isolation of groups of black and yellow hairs on the abdominal tergites of *palus*. Males may be readily distinguished by the color of hairs on the upper margin of the mesanepisternum, yellow in *palus*, white in *sphagnicolus*, and the difference in length of the eye hairs. The nature of the collection site, whether a sphagnum bog or a fen, should also contribute to an accurate identification.

The larva of *sphagnicolus* resembles those of *ohioensis* and *thoracicus*, as described and illustrated by Teskey (1969), but more closely the former, based on similarly clavate pubescent projection on the prothorax and greater similarities of abdominal pubescence. All 3 species are quite different from that of *duplex* which was also described in the same publication, but under the name of *pematicus*. It differs from both in a somewhat intermediate development of anterior pubescence and in the more extensive development of posterior pubescence. The pupa differs from those of *ohioensis* and *thoracicus* in having darker and



more extensive integumental markings, these forms having either no contrasting darker areas of the integument or only a median dark spot on the thorax and no darkening of the head, and almost no contrast between abdominal sclerites and intersegmental integument. Also, the antennal ridges of *ohioensis* are distinctly larger and more ridge-like, not simply a wrinkling of the integument.

### *Atylotus thoracicus* (Hine)

*Tabanus thoracicus* Hine, 1900:248.

**Female.** Length 8-11 mm. Head with subcallus and more or less of frons and median occipital sclerite yellow, remainder black, covered with mainly white pruinosity and white to faintly yellow hairs, including postocular fringe. Eye rarely with partial transverse dark stripe in dried specimens. Frons 3.3-4.2 times as long as basal width, nearly parallel-sided. Basal flagellomere of antenna 1.2-1.7 times as long as greatest width with obtuse dorsal angle and little or no dorsal excision; terminal flagellomeres about as long as width of basal flagellomere. Second palpomere 2.4-3.3 times as long as greatest diameter, constricted and pointed apically; sparsely black-haired.

Thorax and coxae black, covered with whitish pruinosity, with white hairs on pleuron and coxae, and yellowish hairs on scutum and scutellum, usually sparse black hairs only on notopleural lobes. Legs, except coxae, predominantly yellow; base of mid and hind femora sometimes blackened, predominantly black-haired. Wing with costal cell faintly yellow-tinted; setae on anterior veins usually predominantly yellow. Halter yellow. Calypterale tuft of hairs faintly yellow.

Abdomen usually with side of first three or four tergites broadly yellow, leaving dark greyish median stripe, that expands posteriorly; sternites predominantly yellow, usually with sternite 1 and median triangle on sternite 2 dark; entire abdomen with yellow hair except for sparse erect black hairs on terminal two or three tergites and sternites.

**Male.** Apart from usual sexual difference, differs from female as follows: postocular fringe of hairs long, usually extensively black; thorax with longer hair, including some black hair among yellow hairs on scutum; basal  $\frac{1}{3}$  or more of femora blackened; abdomen with rarely more than lateral third of anterior tergites yellow, sternites usually mostly black and all tergites and sternites usually with black hairs mixed with yellow hairs medially.

**Mature larva and pupa.** Described by Teskey (1969).

**Specimens examined.** 129 ♀♀, 127 ♂♂, including lectotype ♀ in U.S.N.M., distributed as shown in Fig. 10.

**Comments.** Adults of this species are readily distinguished by the character combination of scutal and abdominal pale yellowish hairs; sparse black hairs on palps, notopleural lobes, scutum and abdomen; postocular fringe of hairs white in female and at least partly black in males; setae on anterior wing veins mostly yellow.

Adults have apparently never been collected outside the confines of acidic sphagnum bogs. Here they seem to be restricted to the open bog moor, away from the lowest of shrub growth. They seem to be rather sedentary, flying only when disturbed and then for only short distances. There are no records of their attempting to take blood. Larvae have been found in compacted sphagnum moss interlaced by grass roots in drier portions of a bog mat, devoid of shrubby growth (Teskey 1969).

### *Atylotus woodi* Pechuman

This species was recently described by Pechuman (1981). I can add nothing to his descriptions or comments. The larva and pupa of this species were described by Teskey (1969)

under the designation "sp.C". The habitat in which they were found, a marl bog near Puslinch, Ontario, has produced immatures of several other *Atylotus* discussed here.

Only one other locality can be added to the distributional picture given by Pechuman, and this is a grassy fen near Richmond, Ontario, where 2 females were collected on 11 August in both 1978 and 1983.

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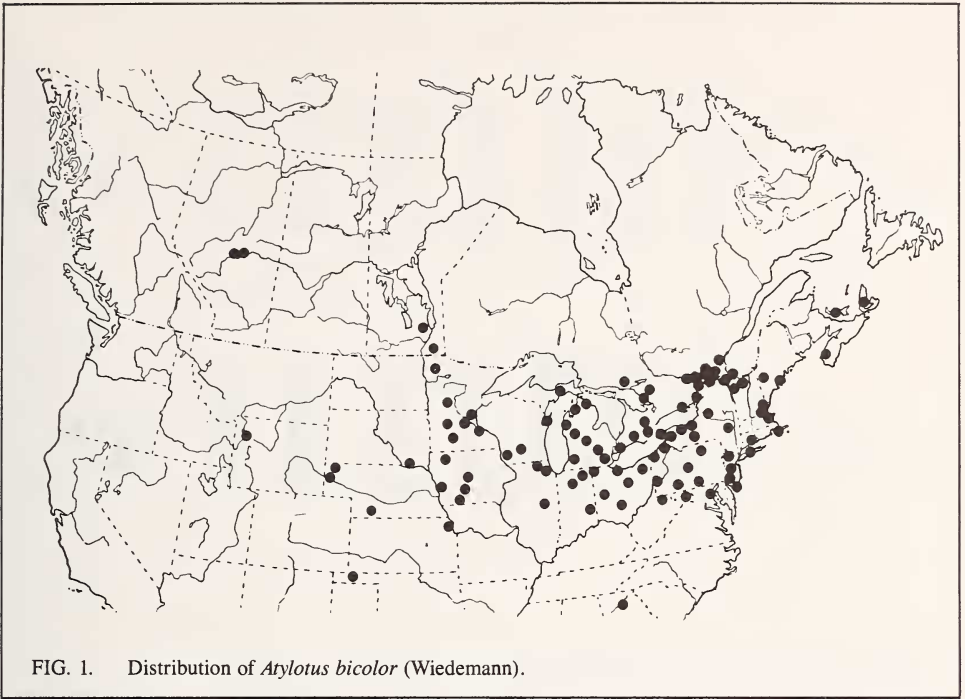


FIG. 1. Distribution of *Atylotus bicolor* (Wiedemann).

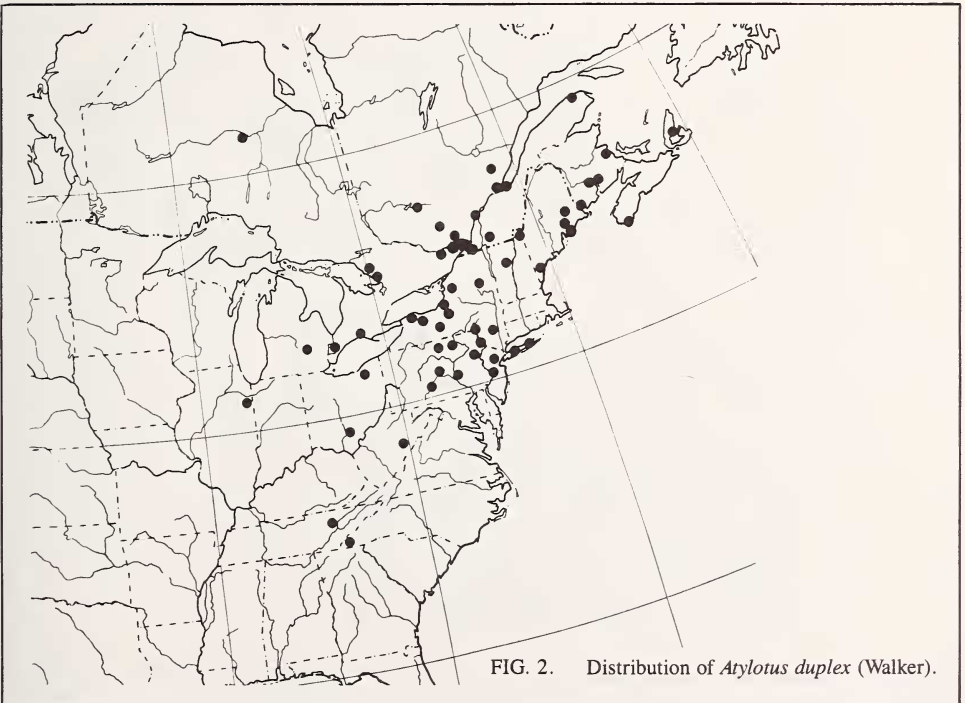
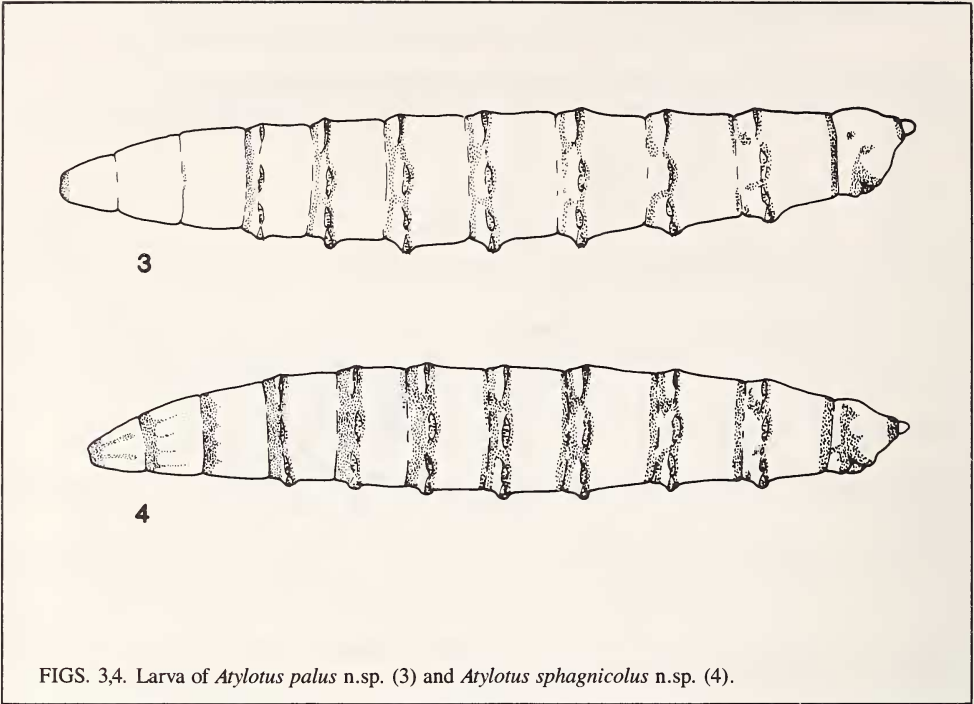


FIG. 2. Distribution of *Atylotus duplex* (Walker).



FIGS. 3,4. Larva of *Atylotus palus* n.sp. (3) and *Atylotus sphagnicolus* n.sp. (4).

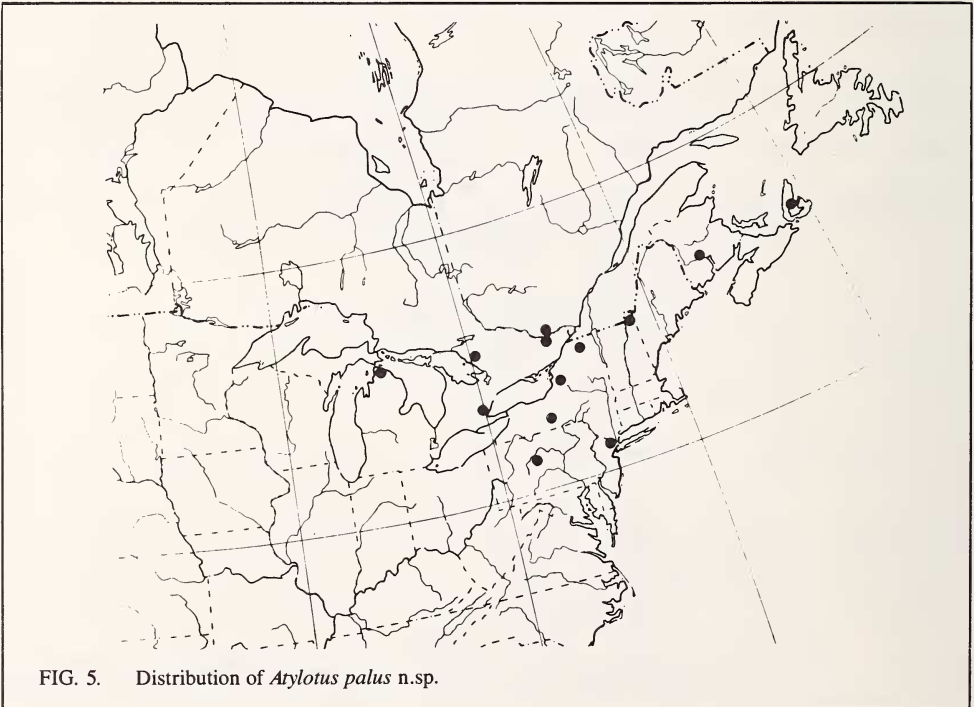


FIG. 5. Distribution of *Atylotus palus* n.sp.

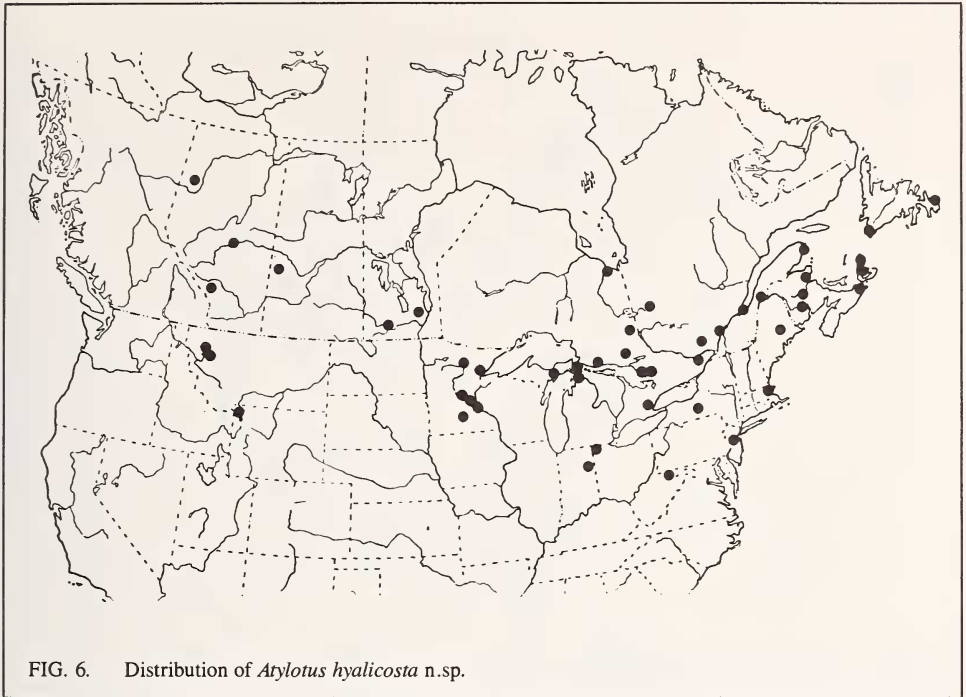


FIG. 6. Distribution of *Atylotus hyalicosta* n.sp.

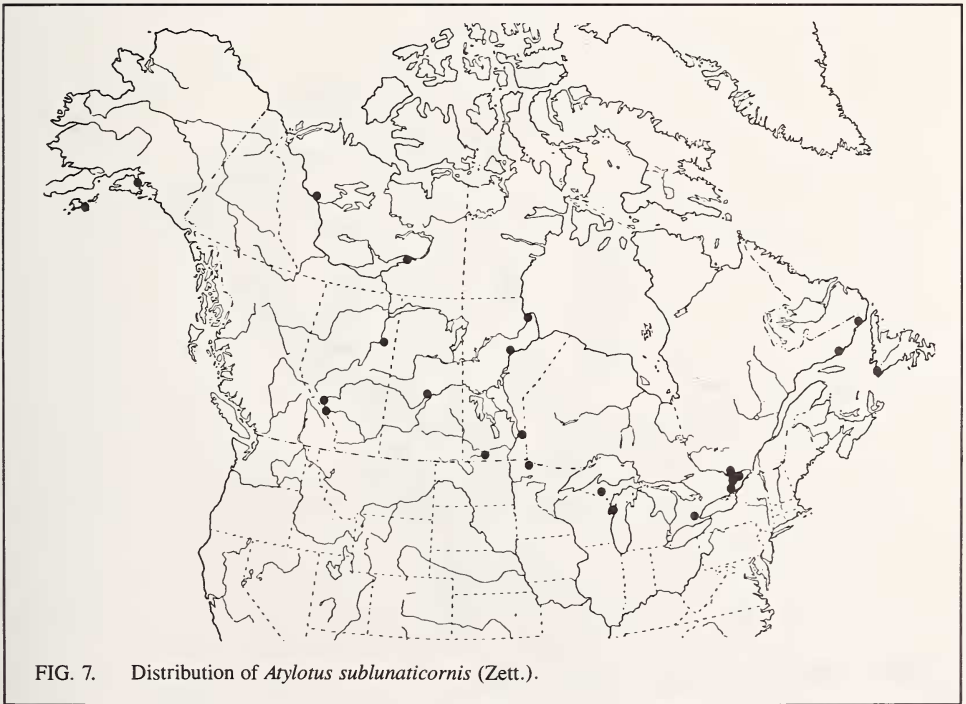


FIG. 7. Distribution of *Atylotus sublunaticornis* (Zett.).



FIG. 8 Distribution of *Atylotus ohioensis* (Hine).

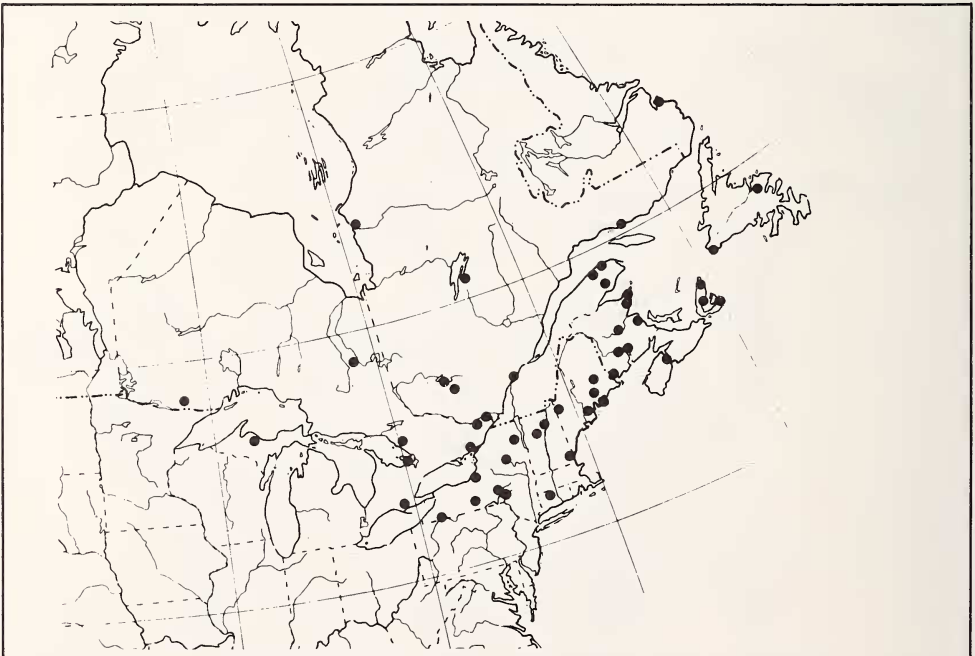


FIG. 9. Distribution of *Atylotus sphagnicolus* n.sp.

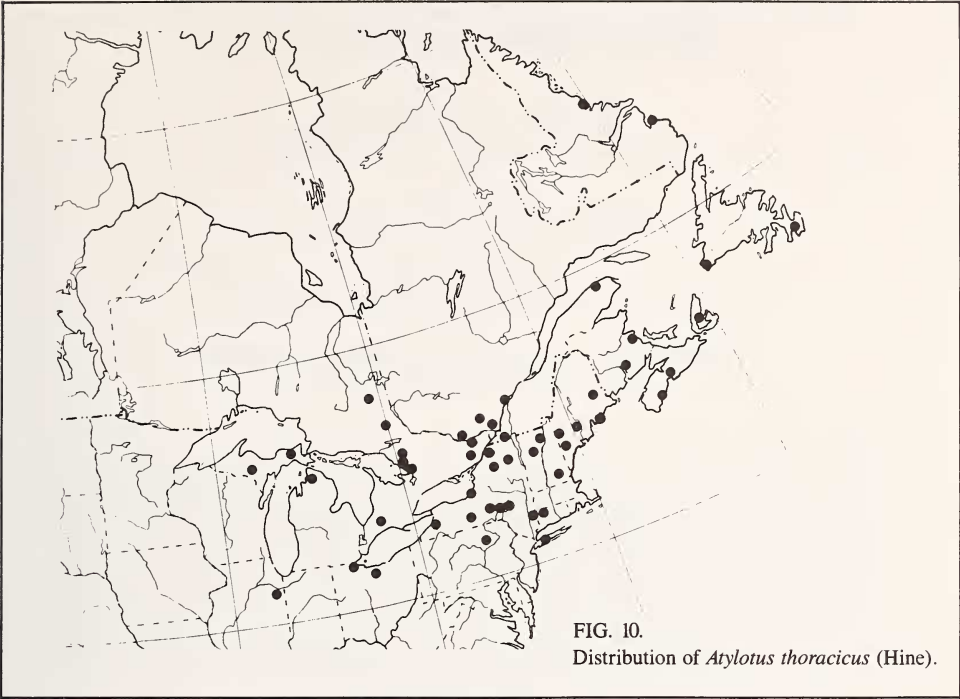


FIG. 10.  
Distribution of *Atylotus thoracicus* (Hine).